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CONVEYING AN ESSENTIALLY SHEET-SHAPED ELEMENT, IN PARTICULAR, A SHEET OF PRINTING MEDIUM

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CROSS-REFERENCE TO RELATED APPLICATIONS

Reference is made to the following commonly assigned applications, the disclosure of which is incorporated herein by reference:

U.S. Patent Application Serial No. _____, filed on March 1, 2004, by Dobrindt, entitled, "TRANSPORTING AN ESSENTIALLY SHEET-LIKE ELEMENT, PARTICULARLY IN A PRINTING PRESS";

U.S. Patent Application Serial No. _____, filed on March 1, 2004, by Dobrindt, entitled, "APPARATUS FOR TRANSPORTING A SHEET-LIKE ELEMENT";

U.S. Patent Application Serial No. _____, filed on March 1, 2004, by Dobrindt, entitled, "TRANSPORTING AN ESSENTIALLY SHEET-SHAPED ELEMENT, PARTICULARLY A PRINT MATERIAL SHEET"; and

U.S. Patent Application Serial No. _____, filed on March 1, 2004, by Dobrindt, entitled, "CONVEYING AN ESSENTIALLY SHEET-SHAPED ELEMENT, IN PARTICULAR, A SHEET OF PRINTING MEDIUM".

FIELD OF THE INVENTION

The invention relates to conveying an essentially sheet-shaped element, in particular, for conveying a sheet of printing medium in a printing machine. The sheet-shaped element is picked up by at least one rotating conveying component having at least one jaw-shaped receiver for introducing or inserting the leading edge of the sheet-shaped element at a pickup point located in the area of its leading edge, and is carried along to a stacking point where it is stacked, whereby the sheet-shaped element is bowed around a rotational radius or a radius of curvature.

BACKGROUND OF THE INVENTION

A process and an apparatus for conveying a sheet-shaped element are known in prior art from a patent described in DE 199 04 853. Therein, a stacking wheel is used as a rotating conveying component for conveying and stacking banknotes, in particular. For this purpose, banknotes are introduced

individually into jaw-shaped receivers and held there. For the purpose of securely holding the banknotes, spring-loaded limiting blades are linked to the jaw-shaped receivers in order to achieve a radial force component that is oriented inward toward the wheel hub of the conveying component, by which the individual banknote is clamped in the jaw-shaped receiver. In this regard, care must be taken in order to avoid damage to the edge of the element caused by reaching the end of travel. That is, the sheet-shaped element must not, just for the sake of holding the sheet-shaped element firmly in the jaw-shaped receiver, be inserted too deeply into the receiver such that it reaches the receiver's end of travel. The known conveyor is, from a mechanical standpoint, relatively expensive and subject to malfunctioning, and is relatively undependable due to its reliance upon spring tension during the grasping, conveying, and stacking of the sheet-shaped element.

SUMMARY OF THE INVENTION

Consequently, the objective of this invention is to raise the level of reliability during sheet-shaped element conveying and stacking, in particular, at higher conveyance speeds and preferably without regard to the characteristics of the sheet-shaped element.

This object is achieved in that the sheet-shaped element is held by at least one retaining component located in the area of the jaw-shaped receiver, in particular, proactively, and by force. In this manner the sheet-shaped element is held securely, conveyed, and released at the proper place for stacking. Preferably, provision is made for the sheet-shaped element to be subject to a clamping pressure applied by the retaining component in the jaw-shaped receiver, in order to hold it securely with a simple mechanism and, at the same time, to avoid damaging it. An apparatus, according to the invention, has at least one retaining component located in the area of the jaw-shaped receiver.

A preferred embodiment of the apparatus according to the invention provides for the retaining component to be a retaining rod that may be moved back and forth in an approximately radial direction to the rotational movement of the conveying component, and that rotates along with the conveying component.

The co-rotational retaining rod that is assigned to the jaw-shaped receiver can beneficially be moved preferably radially outward after a sheet-shaped element has been introduced into the receiver, in order to hold the sheet-shaped element in the receiver, in that the retaining rod thrusts against its countervailing force on a wall of the receiver, against which it presses the sheet-shaped element. After conveyance, the retaining rod can be moved so as to open the jaw-shaped receiver, in order to release the sheet-shaped element for stacking.

A further development of the invention provides for the retaining component to be movable by an actuating component that is stationary relative to the conveyance component and the retaining component, and that is essentially an eccentric or a cam, such that the eccentric in at least one rotational position of the conveyance component essentially closes the jaw-shaped receiver by the retaining component and, in at least one other relative rotational position, leaves the jaw-shaped receiver essentially open.

Thus, the retaining rod is forced to move in a closing direction by a cam, whenever it passes the stationary cam during rotation of the conveyance component. For this, the cam must be aligned, oriented, and extended in the direction of rotation such that the retaining rod is closed at the correct point in time during the rotation and remains closed for the proper amount of time. At the end of the cam area or, in general the area of the eccentric in the direction of rotation, the retaining rod once again is given sufficient clearance for movement. It is not necessary that the rod be forced in an opposite direction. In principal, it can remain in the closed position without imposing pressure. The absence of pressure is, however, sufficient for releasing the sheet-shaped element, which is now no longer clamped in place, if it is, for example, pushed out of the jaw-shaped receiver. It is, of course, also conceivable, although more expensive, for the retaining rod to be mechanically forced back into the open position. For example, a crankshaft and piston rod could be provided, connected to the retaining rod and which, for example, turns coaxially to the conveyance component at a particular speed ratio to that of the conveyance component, e.g., speed ratio of 1:2. In general, instead of a stationary actuating component, an actuating component that rotates at a different speed than that of the conveyance component can be

provided so that in every situation a relative angular velocity between the actuating component and the conveyance component and/or the retaining rod exists.

It is preferable that the eccentric or cam be a cam disc next to the hub area of the conveyance component. In particular, the cam disc should rest on a stationary (or rotating) axle on which a drive shaft of the conveyance component rotates coaxially as a hollow shaft.

In a simple embodiment, the retaining rod can be essentially a piston rod that extends radially relative to the conveying component, and that is located in a radially-oriented slot guide in the conveying component. As such, the piston rod can move back and forth. The end of the piston rod that is turned away from the jaw-shaped receiver runs along the eccentric or cam when the conveying component is rotating. The conveying component in this embodiment can be essentially in the shape of a disc. The conveying component and/or the retaining rod or piston rod could be manufactured sturdily and at a reasonable cost, such as from plastic.

Another development of the invention provides for a number of jaw-shaped receivers to be evenly distributed over a full 360° of the conveying component disk, and for a retaining component to be assigned to each jaw-shaped receiver. In this manner, the apparatus can convey two or more sheet-shaped elements simultaneously. Preferably, two jaw-shaped receivers are provided so as to be able to grasp the next sheet-shaped element to be conveyed, precisely as the sheet-shaped element that was just conveyed is stacked, the two jaw-shaped receivers being located diametrically opposite to one another.

In addition, provision can beneficially be made for the at least one jaw-shaped receiver to be essentially a slot or slit. In doing so, care can beneficially be taken for the length of the slot to incorporate sufficient clearance for the leading edge of the sheet-shaped element, without the danger that the leading edge will butt against the face of the slot.

At the point of release, delivery and stacking of the sheet-shaped element can be simply achieved in that in the area of the point of release a stationary arresting bar for the leading edge of the sheet-shaped element that is inserted in the jaw-shaped receiver is located across from the conveying component, and against which the sheet-shaped element bumps such that the sheet-shaped element comes loose from the jaw-shaped receiver when the conveying component itself, unimpeded by the arresting bar, continues to move. For this purpose, a strap can be provided that has sufficient clearance for the conveying component.

For a better alignment of the sheet-shaped element, even while being conveyed, provision is preferably made for two or more conveying components that are coaxially separated from one another. Preferably, the two conveying components are aligned as mirror images in relation to a reflective plane that is perpendicular to the rotational axis.

BRIEF DESCRIPTION OF THE DRAWINGS

Shown in the drawing is an embodiment from which additional inventive characteristics can also be derived, but to which the invention is not limited. Shown schematically are:

FIG. 1 which is a side sectional view of a conveying component according to the invention; and

FIG. 2 which is a front view of the conveying component shown in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 shows a conveying component according to the invention. This conveying component incorporates a stacking disk 1, the full surface of one side of which can be seen. A section I – I, cut approximately along its median plane, i.e., along the dashed line I – I, is shown in FIG. 2 and depicted in the direction of view indicated by the arrow shown in FIG. 2.

The stacking disk 1 rests on a hollow shaft 8 (FIG. 2) and is attached to it by a flange 10. This hollow shaft 8 can be driven by a drive mechanism (not shown) in order to rotate the stacking disk 1. For its part, the hollow shaft 8 runs on a stationary axle 6, on which an eccentric or cam, or a cam

disk 5 is located, and which is static in relation to the stacking disk 1. The cam area of the cam disk 5, which brings about a radially greater distance from the axle 6 than the remaining area of the cam disk 5 extends circumferentially approximately around a sector 7.

The stacking disk 1 has two slots 2 that, in relation to the axle 6, are located diametrically, and point symmetrically opposite to one another and serve as jaw-shaped receivers for 7 holding sheet-shaped elements 3. The leading edge of a sheet-shaped element 3 is pushed into a slot 2 that is located in the upper position at the depicted point of rotation of the stacking disk. To insert the sheet-shaped element 3 into the slot 2, conveying rollers at the end of a paper path (not shown), are used. The sheet-shaped element 3 that has been inserted is then brought to a lower level by a half-rotation of the stacking disk 1, where it is pushed out of the slot 2 that is now in the lower position, and then stacked on a stack (not shown). Such a sheet-shaped element 3' that is in the process of being stacked is also shown in FIG. 1. The sheet-shaped element 3' is pushed out of the slot 2 by an arresting bar 9 that is depicted in FIG. 2. The arresting bar 9 has an opening through which the stacking disk 1 can rotate without being impeded, whereby, however, the sheet-shaped element butts against the arresting bar 9 and is held back such that it comes out of the slot 2 as the slot 2 continues to move.

In the stacking disk 1, a radially-oriented retaining rod 4 that works like a piston rod is located in a radially-oriented guide slot wherein it can move back and forth. One end of the retaining rod 4 projects into the slot 2 while its other end runs on the cam disk 5 as it rotates in conjunction with the stacking disk 1 and the axle 6. When it is in the cam area 7, the retaining rod 4 is always forcibly moved radially outward for the corresponding length of time, or for the corresponding angle of rotation, more or less "lifted up" from the axle 6. Accordingly, the outward facing end penetrates laterally more deeply into the slot 2 and presses a sheet-shaped element 3 that has been picked up, against the wall of the slot with retentive pressure. Thus, the retaining rod 4 immobilizes the sheet-shaped element 3 or 3' while it moves counterclockwise downward with the stacking disk in FIG. 1, and its trailing edge is released by the conveyer rollers of the paper path (not shown) that were already mentioned above and the sheet-

shaped element requires additional support. The retaining rod 4 releases (for the first time) the sheet-shaped element 3' at that same moment when its leading edge (turned in the meantime) abuts against the arresting bar so that the sheet-shaped element 3' can come out of the slot 2 to be stacked.

This additional support that is provided to sheet-shaped element 3, 3' in the slot by the retaining rod 4 is particularly effective in the case of sheets that are larger in size, for example, above DIN A 3 and/or have a higher specific gravity, for example, 300 grams pr square meter. Consequently, such sheet-shaped elements are stiffer because these types of sheets are longer and more difficult to bow and therefore preferably necessitate a stacking disk 1 of greater diameter, for example, one of at least 90 millimeters. This additional support is, however, particularly useful for smaller sizes when they are conveyed on a larger stacking disk 1, because the smaller sized sheets are even more certain to be released by the previously mentioned conveying rollers long before they have reached the lower stacking position.

FIG. 2 shows a frontal view of the conveying component shown in FIG. 1. The same components are identified with the same reference numbers as in FIG. 1. FIG. 2 more clearly depicts, in particular, the alignment of the axle 6 and the hollow shaft 8, the surface of the sheet-shaped element 3, and the location of the arresting bar 9.

The invention has been described in detail with particular reference to certain preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.